the monocotyledons (*Yucca* to *Agave*), and also an extensive supplement (pp. 869–1065) to all the preceding parts.—J. M. C.

North American flora.[5]—Volume **17,** part 2, contains the Poaceae (in part) from the genus *Arthraxon* to *Paspalum* by GEORGE VALENTINE NASH. One new genus is proposed, namely *Schaffnerella*, based on *Schaffnera gracilis* Benth. from Mexico. Several transfers are made, and new species are described in the following genera: *Schizachyrium* (4), *Andropogon* (1), *Amphilophis* (1), *Sorghastrum* (1), *Aegopogon* (2), and *Paspalum* (6).—J. M. GREENMAN.

NOTES FOR STUDENTS

Cytology of Polytrichum.—What is to be regarded as the first critical work on the cytology of mosses appears in a recent number of *Archiv für Zellforschung*. ALLEN[6] has studied and described with great care the structure and division of the antheridial cells of *Polytrichum*. For the sake of accuracy he finds it advisable to introduce several new terms: the cells which are to be metamorphosed into spermatozoids are referred to as *androcytes*, those of the penultimate generation as *androcyte mother cells*, and those of all the earlier generations as *androgones*.

In all androgones a deeply staining kinoplasmic mass is present in the cytoplasm; in the earlier generations it has the form of a large plate, while in the later generations it usually exists as a group of smaller bodies or "kinetosomes." All transitions between the two conditions are found. Previous to mitosis, the plate divides to two daughter plates, or in the case of the kinetosomes into two daughter groups, which move apart and occupy positions at opposite sides of the nucleus. Before the division of the plate a few achromatic fibers connect it with the nuclear membrane, and when the divergence of the daughter plates is complete these have increased greatly in number, determining the position and extent of the future broad-poled spindle. In the cells with kinetosomes there are no fibers discernible until the migrating groups reach their final positions. The spindle at length includes connecting fibers, mantle fibers, and usually a few short, freely ending ones.

The resting nucleus contains a single deeply staining mass made up of both nucleolar material and chromatin, and a sparse reticulum composed of chromatin and linin. As mitosis approaches, the nucleus enlarges until its membrane touches the polar plates or kinetosomes, while the material of the reticulum forms a spirem which segments into chromosomes. The presence of nucleoli at this stage offers additional evidence that the chromatin and nucleolar substance are distinct. The nucleus now collapses and the chromatin

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[5] North American flora, vol. **17,** part 2, pp. 99–196. New York Botanical Garden. September 18, 1912.

[6] ALLEN, C. E., Cell structure, growth, and division in the antheridium of *Polytrichum juniperinum* Willd. Archiv für Zellforschung **8**: 121–188. *pls. 6–9.* 1912.

becomes compacted into a tight knot. Soon the six chromosomes, all U-shaped and closely similar, disentangle themselves from this knot and become arranged on the spindle. They split longitudinally, separate, and reorganize the daughter nuclei in the usual way. During the anaphases and telophases the connecting fibers between the chromosome groups increase in number, pull away from the chromosomes, and become thickened at their ends. These thickenings apparently move toward each other and meet in the equatorial region, where by further swelling of the fibers the cell plate is formed. The splitting of the cell plate and the deposition of a wall between its halves were not observed, but are believed to occur.

In the androcyte mother cells there are a few granules, but nothing which can be certainly identified with the kinetosomes, whose bulk has been diminishing through the generations of androgones. There is, however, in each of them a small "central body" at the center of an aster in the cytoplasm. There is no evidence that it originates within the nucleus. It divides to two which diverge, each with an aster, to opposite sides of the nucleus. Some of the astral rays form cones whose bases are at the nuclear membrane, but between the separating daughter centers there is visible no constant connection. The central bodies are located at the sharp poles of the spindle, and as the nucleus swells it comes in contact with them. Although they are less conspicuous from this time on, it is reasonably certain that they persist in every instance through mitosis, which is essentially similar to that in the androgones. In the cytoplasm of each androcyte is a deeply staining granule occupying the position of the pole of the former spindle. This is the blepharoplast and is doubtless identical with the central body of the androcyte mother cell. The development of the spermatozoid is to be taken up in a later paper.

The spermatogenous cells are marked by a condition of polarity which persists throughout the life of each cell and is transmitted through a long series of cell generations. Except during mitosis, there is no trace of a polar arrangement of the nuclear structures.

The kinetosomes are believed to be not comparable to "chondriosomes" or other non-kinoplasmic inclusions of the cytoplasm. They are not definite morphological entities, but rather unorganized masses of reserve kinoplasm. The definite behavior of the plates in the early androgones is regarded as the result of the presence of a large amount of kinoplasm which tends to occupy a fairly definite position relative to the nucleus.

In contrast to the kinetosomes the blepharoplast is a definitely organized cell organ, and although the author believes that the question of its morphological nature is still an open one, he inclines toward the view that it is the homologue of a centrosome. This is strongly warranted by the centrosome-like behavior of the blepharoplasts in *Polytrichum*, with which he ventures to predict other bryophytes will be found to agree. The need of further researches among the Chlorophyceae for light on the origin of the blepharoplast is emphasized.

Although the mitosis in the antheridial cells of *Polytrichum* agrees in general with that in higher plants, certain peculiarities are pointed out which may prove to be of phylogenetic significance. Such are the delay in the preparation of the nucleus for division until after the formation of the spindle rudiment, the great swelling of the nucleus in one dimension during the prophases, the equatorial aggregation of the chromatin following the swelling, and the final shrinkage of the nucleus. It is yet too early to say whether any or all of these features are generally characteristic of mitosis in bryophytes, but many fragmentary observations make this appear quite possible.

The comprehensive review of cytological work in the bryophytes and the extensive list of literature brought together contribute much toward rendering this paper of the highest value to students of cytology.—LESTER W. SHARP.

Mallow rust.—In an elaborate paper ERIKSSON[7] gives the results of many years' investigations on the mallow rust, which, coming originally from South America, has been introduced into Europe, North America, and other countries. The work is replete with experiments and observations covering all phases of the biology and life history of this fungus, which presents peculiar features of interest, first, because in the countries into which it has been introduced it has spread to many plants not native in its original habitat, and second because, being one of the lepto-Uredinales whose teleutospores germinate at maturity, its manner of living from season to season has not been satisfactorily explained. It is in fact this latter phase of the subject which forms the pivot of ERIKSSON's investigation, and upon which he brings to bear the results of a vast amount of painstaking work.

The main contentions of ERIKSSON are that the fungus persists in the seed of infected plants in the form of a mycoplasma, and that it is disseminated chiefly by means of infected seed. The mass of experimental and observational data upon which he bases these contentions are briefly summarized here.

The historical data relating to the distribution of the fungus show that in many places it was first observed on plants grown from seed obtained from infected nurseries. The fungus is not spread to great distances by means of the sporidia. Wide dissemination is brought about by means of infected seeds or seedling plants containing the fungus in the mycoplasma stage. In plants grown from infected seeds the first outbreak of the disease occurs regularly when the plants are about three months old. This period is required for the mycoplasma to change into the filamentous stage and produce spore pustules. The pustules of the primary outbreak are very numerous and are uniformly scattered over the leaves of the young plant, while those of the

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[7] ERIKSSON, J., Der Malvenrost (*Puccinia Malvacearum* Mont.), seine Verbreitung, Natur, und Entwickelungsgeschichte. Kungl. Svensk. Vetensk. Handl. **47**: 5–120. *pls. 6. figs. 18.* 1911. For summaries previously published by the author see Compt. Rend. **152**:1776–1779. 1911, and Centralbl. Bakt. **31**:93–95. 1911.